WHAT IS CLAIMED IS:

1. A magnetic detecting element comprising:

a multilayer film comprising a first antiferromagnetic layer, a pinned magnetic layer, a nonmagnetic material layer and a free magnetic layer, which are laminated in that order on a substrate; and

a magnetization control layer for controlling magnetization of the free magnetic layer,

wherein the pinned magnetic layer comprises a first magnetic layer extending in the track width direction in contact with the first antiferromagnetic layer, a second magnetic layer facing the first magnetic layer in the thickness direction, and a nonmagnetic intermediate layer interposed between the first and second magnetic layers, the magnetizations of the first and second magnetic layers being antiparallel to each other;

the first antiferromagnetic layer has a predetermined space in the track width direction so that the first antiferromagnetic layer is in contact with both side portions of the first magnetic layer in the thickness direction; and

the electric resistance in the space changes in relation to the magnetization direction of the free magnetic layer and the magnetization direction of the second magnetic layer.

2. The magnetic detecting element according to claim 1, wherein the multilayer film comprises a free magnetic layer, a nonmagnetic material layer, a pinned magnetic layer and a

first antiferromagnetic layer, which are laminated in that order from below, and the magnetization control layer comprises a second antiferromagnetic layer provided below the free magnetic layer to have a predetermined space in the track width direction so that the magnetization control layer is in contact with the bottoms of both side portions of the free magnetic layer, the first antiferromagnetic layer being in contact with the tops of both side portions of the first magnetic layer constituting the pinned magnetic layer.

3. The magnetic detecting element according to claim 2, wherein the magnetization control layer comprises permanent-magnet layers in direct contact with both side portions of the free magnetic layer.

4. The magnetic detecting element according to claim 2, wherein assuming that the minimum dimension of the space provided in the first antiferromagnetic layer in the track width direction is WP, and the minimum dimension of the space provided in the magnetization control layer in the track width direction is Wf1, Wf1 is the same as or smaller than WP.

5. The magnetic detecting element according to claim 1, wherein the multilayer film comprises a free magnetic layer, a nonmagnetic material layer, a pinned magnetic layer and a first antiferromagnetic layer, which are laminated in that order from below, the magnetization control layer comprises permanent-magnet layers provided on both sides of at least

the free magnetic layer and the nonmagnetic layer in the track width direction, the pinned magnetic layer is disposed on the nonmagnetic material layer to partially or entirely extend from the nonmagnetic layer to the permanent-magnet layers, and the first antiferromagnetic layer is provided in contact with the both side portions of the first magnetic layer constituting the pinned magnetic layer.

6. The magnetic detecting element according to claim 5, wherein both side regions comprising the respective permanent-magnet layers are disposed on both sides of at least the free magnetic layer and the nonmagnetic material layer in the track width direction, and the pinned magnetic layer is provided on the nonmagnetic material layer to extend from the nonmagnetic material layer to both side regions of the element.

7. The magnetic detecting element according to claim 5, wherein both side regions comprising the respective permanent-magnet layers are disposed on both sides of at least the free magnetic layer, the nonmagnetic material layer and the second magnetic layer and nonmagnetic intermediate layer constituting the pinned magnetic layer in the track width direction, and the first magnetic layer constituting the pinned magnetic layer is provided on the nonmagnetic intermediate layer to extend from the nonmagnetic intermediate layer to both side regions of the element.

8. The magnetic detecting element according to claim 5, wherein assuming that the minimum dimension of the space provided in the first antiferromagnetic layer in the track width direction is WP, and the minimum width dimension of the free magnetic layer in the track width direction is Wf2, Wf2 is the same as or smaller than WP.

9. The magnetic detecting element according to claim 1, wherein the multilayer film comprises a first antiferromagnetic layer, a pinned magnetic layer, a nonmagnetic material layer, and a free magnetic layer, which are laminated in that order from below, and the first antiferromagnetic layer is provided with a predetermined space in the track width direction so that the first antiferromagnetic layer is in contact with the bottoms of both side portions of the first magnetic layer in the track width direction.

10. The magnetic detecting element according to claim 9, wherein the substrate provided below the first antiferromagnetic layer has recessed portions provided in both side portions in the track width direction to have a predetermined depth, the first antiferromagnetic layer being disposed in the recessed portions with the predetermined space in the track width direction.

11. The magnetic detecting element according to claim 9, wherein the magnetization control layer comprises a second

antiferromagnetic layer provided on the free magnetic layer to make contact with both side portions of the free magnetic layer and have a predetermined space in the track width direction.

12. The magnetic detecting element according to claim 11, wherein assuming that the minimum dimension of the space provided in the first antiferromagnetic layer in the track width direction is WP, and the minimum dimension of the space provided in the magnetization control layer in the track width direction is Wf3, Wf3 is the same as or smaller than WP.

13. The magnetic detecting element according to claim 9, wherein permanent-magnet layers each serving as the magnetization control layer are provided on both sides of the free magnetic layer in the track width direction so that the bottoms of the permanent-magnet layers are positioned above at least the pinned magnetic layer.

14. The magnetic detecting element according to claim 13, wherein assuming that the minimum dimension of the space provided in the first antiferromagnetic layer in the track width direction is WP, and the minimum width dimension of the free magnetic layer in the track width direction is Wf4, Wf4 is the same as or smaller than WP.

15. The magnetic detecting element according to claim 4, wherein the minimum dimension WP is 0.2 μm or less.

16. The magnetic detecting element according to claim 1, further comprising electrode layers provided on both side portions of the multilayer film in such a manner that the direction of a sensing current magnetic field formed by a sensing current flowing from the electrode layers to the multilayer film coincides with the direction of a synthetic magnetic moment per unit area of the magnetic layers constituting the pinned magnetic layer.

17. The magnetic detecting element according to claim 1, further comprising a nonmagnetic metal layer having the same composition as that of the first antiferromagnetic layer and provided in the space to make contact with the first magnetic layer, the nonmagnetic metal layer provided in the space being a disordered crystal structure layer thinner than the first antiferromagnetic layer.

18. The magnetic detecting element according to claim 17, wherein the crystal of the first magnetic layer is epitaxial or heteroepitaxial with the crystal of the nonmagnetic metal layer, the end surface of the pinned magnetic layer is open near a surface facing a recording medium, and the nonmagnetic metal layer is made of a PtMn alloy or X-Mn alloy (wherein X is at least one element of Pt, Pd, Ir, Rh, Ru, Os, Ni, and Fe).

19. The magnetic detecting element according to claim

18, wherein in the vicinity of the interface with the central portion of the first magnetic layer or over the entire region of the nonmagnetic metal layer, the nonmagnetic metal layer assumes a face-centered cubic lattice (fcc) structure in which an equivalent crystal plane represented by a {111} plane is preferentially oriented in parallel with the interface.

20. The magnetic detecting element according to claim 18, wherein the thickness of the nonmagnetic metal layer is 5 Å to 50 Å.

21. The magnetic detecting element according to claim 18, wherein the Pt content of the PtMn alloy or the content of X element in the X-Mn alloy is 55 atomic percent to 95 atomic percent.

22. The magnetic detecting element according to claim 18, wherein in the vicinity of the interface with the nonmagnetic metal layer or over the entire region of the central portion of the first magnetic layer of the pinned magnetic layer, at least the central portion facing the nonmagnetic metal layer in the thickness direction assumes a face-centered cubic lattice (fcc) structure in which an equivalent crystal plane represented by a {111} plane is preferentially oriented in parallel with the interface.

23. The magnetic detecting element according to claim

22, wherein the first magnetic layer of the pinned magnetic layer is made of Co or Co_xFe_y ($y \leq 20$, $x+y = 100$).

24. The magnetic detecting element according to claim 18, wherein in the vicinity of the interface with the nonmagnetic metal layer or over the entire region of the central portion of the first magnetic layer of the pinned magnetic layer, at least the central portion facing the nonmagnetic metal layer in the thickness direction assumes a body-centered cubic lattice (bcc) structure in which an equivalent crystal plane represented by a {110} plane is preferentially oriented in parallel with the interface.

25. The magnetic detecting element according to claim 24, wherein the first magnetic layer of the pinned magnetic layer is made of Co or Co_xFe_y ($y \geq 20$, $x+y = 100$).

26. The magnetic detecting element according to claim 18, wherein in the vicinity of the interface with the nonmagnetic metal layer, at least the central portion of the first magnetic layer of the pinned magnetic layer facing the nonmagnetic metal layer in the thickness direction assumes a face-centered cubic lattice (fcc) structure in which an equivalent crystal plane represented by a {111} plane is preferentially oriented in parallel with the interface, and in the vicinity of the interface with the nonmagnetic intermediate layer, the central portion assumes a body-centered cubic lattice (bcc) structure in which an equivalent

crystal plane represented by a {110} plane is preferentially oriented in parallel with the interface.

27. The magnetic detecting element according to claim 26, wherein the first magnetic layer of the pinned magnetic layer has a composition comprising Co or Co_xFe_y ($y \leq 20$, $x+y = 100$) near the interface with the nonmagnetic metal layer, and the first magnetic layer of the pinned magnetic layer has a composition comprising Co_xFe_y ($y \geq 20$, $x+y = 100$) near the interface with the nonmagnetic intermediate layer.

28. The magnetic detecting element according to claim 27, wherein the first magnetic layer of the pinned magnetic layer has a Fe concentration gradually increasing in the direction from the interface with the nonmagnetic metal layer to the interface with the nonmagnetic intermediate layer.

29. The magnetic detecting element according to claim 18, wherein a value obtained by dividing the difference between the distance of nearest neighbor atoms of the nonmagnetic metal layer and that of the central portion of the first magnetic layer of the pinned magnetic layer in the planar direction parallel to the interface by the distance between nearest neighbor atoms of the first magnetic layer is 0.05 to 0.20.

30. The magnetic detecting element according to claim 18, wherein the first magnetic layer has a positive

magnetostrictive constant.

31. The magnetic detecting element according to claim 18, further comprising electrode layers made of Cr, α-Ta or Rh and provided on both sides portions of the magnetic detecting element in the track width direction.